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TITLE: METHOD AND SYSTEM FOR PROVIDING FLEXIBLE VEHICLE COMMUNICATION WITHIN A VEHICLE COMMUNICATIONS SYSTEM

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METHOD AND SYSTEM FOR PROVIDING FLEXIBLE VEHICLE COMMUNICATION WITHIN A VEHICLE COMMUNICATIONS SYSTEM

FIELD OF THE INVENTION

In general, the invention relates to data transmission over a wireless communication system. More specifically, the invention relates to a method and system for providing flexible vehicle communication within a vehicle communication system.

BACKGROUND OF THE INVENTION

Mobile communication units (MCU's), such as cellular phones, personal data assistants (PDA's), and on-board Vehicle Communication Units (VCU's), used in conjunction with a Wide Area Network (WAN), such as a cellular telephone network or a satellite communication system, have made it possible for a person to send and receive voice communications, data transmissions, and FAX messages from virtually anywhere on earth. Such communication is initiated at the MCU when it is turned on, or by entering a phone number to be called, or in many cases, by pressing a preprogrammed button on the MCU or speaking a voice command causing the MCU to automatically complete the process of dialing the number to be called. A radio communication link is established between the MCU and a Wide Area Network (WAN), using a node of the WAN in the vicinity of the MCU.

In cellular telephone systems, a router is commonly referred to as a "cellular base station." Once the radio communication link between the MCU and the cellular base station has been established, the base station then utilizes a combination of additional cellular stations, conventional telephone wire line networks, and possibly even satellite systems to connect the MCU to the number or data node (e.g. IP address) to be accessed.

Wireless communication services for MCU users, such as navigation and roadside assistance, have increased rapidly in recent years. Services offered are for either a motor vehicle in operation or a non-operational motor vehicle. Services offered for a motor vehicle in operation include navigation assistance, stolen vehicle tracking, remote diagnostics, and the like. Services offered for a non-operational motor vehicle include remote door-lock release, emergency services, remote horn and lights, and the like.

MCU service providers must make available a wireless communication service customer assistance center (or other such manually staffed service center) in order that an operator or customer assistant may complete the MCU requests. Recently, some MCU service providers have made access to MCU requests available to the customer via the Internet and the World Wide Web. This availability has allowed customers to modify the many different options available within the vehicle depending on vehicle equipment and the service-level the customer has purchased.

Conventional vehicles receive specific embedded logic at the time of manufacture, and as new model year vehicles become available with new service-levels older models likely will not be retrofitted due to cost factors. Unfortunately, this presents a number of negative issues for the manufacturer, such as, for example requiring future products to provide legacy support.

It would be desirable, therefore, to provide a method and system that would overcome these and other disadvantages.

SUMMARY OF THE INVENTION

One aspect of the invention includes a method for providing a custom message set within a vehicle message service system. The method includes receiving at least one vehicle message service request, determining at least one set of vehicle parameters based on the at least one received vehicle message service request, requesting at least one vehicle message for each of the at least one set of vehicle parameters from a database, and generating the custom message set based on the vehicle messages.

In accordance with another aspect of the invention, a computer readable medium storing a computer program includes: computer readable code for determining at least one set of vehicle parameters based on at least one received vehicle message service request; computer readable code for requesting at least one vehicle message for each of the at least one set of vehicle parameters from a database; and computer readable code for generating the custom message set responsive to the vehicle messages.

In accordance with yet another aspect of the invention, a system for providing a custom message set within a vehicle message service system is provided. The system includes means for receiving at least one vehicle message service request. The system additionally includes means for determining at least one set of vehicle parameters based on the at least one received vehicle message service request. Means for requesting at least one vehicle message for each of the at least one set of vehicle parameters from a database is provided. Means for generating the custom message set responsive to the vehicle messages is also provided.

The foregoing and other features and advantages of the invention will become further apparent from the following detailed description of the presently preferred embodiment, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the invention rather than limiting, the scope of the invention being defined by the appended claims and equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram illustrating an operating environment in accordance with one embodiment of the present invention;

FIG. 2 is a block diagram illustrating a system for providing a custom message set in accordance with one embodiment of the present invention; and

FIG. 3 is a flow diagram depicting an exemplary embodiment of code on a computer readable medium in accordance with the present invention.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENT

Illustrative Operating Environment

FIG. 1 is a block diagram illustrating an example of an operating environment that is in accordance with the present invention. **FIG. 1** details an embodiment of a system for operating a wireless communication service in a mobile vehicle, and may be referred to as a mobile vehicle communication system (MVCS) **100**. The mobile vehicle communication system (MVCS) **100** may include one or more mobile vehicle communication units (MVCU) **110**, one or more MVCS devices **115**, one or more wireless communication systems **120**, one or more communication networks **150**, one or more land networks **160**, and one or more service providers **170**. In an example, MVCS **100** is implemented as an OnStar® system available from OnStar® Corp., a subsidiary of General Motors Corp. of Troy, MI, as is known in the art.

MVCU **110** includes a wireless vehicle communication device (module, MVCS module) such as an analog or digital phone with suitable hardware and software for transmitting and receiving data communications. In one embodiment, MVCU **110** further includes a wireless modem for transmitting and receiving data. In another embodiment, MVCU **110** includes a digital signal processor with software and additional hardware to enable communications with the mobile vehicle and to perform other routine and requested services.

In operation, MVCU **110** sends and receives radio transmissions from wireless communication system **120**. MVCU **110** may also be referred to as a mobile vehicle throughout the discussion below. MVCU **110** may be implemented as a motor vehicle, a marine vehicle, or as an aircraft.

MVCS device **115** includes hardware suitable for receiving broadcast signals within MVCU **110**. In one embodiment, MVCS device **115** includes a receiver and receives broadcasts from wireless communication system **120.** In another embodiment, MVCS device **115** further includes a medium for storing programming information. In an example, the programming information includes provider supplied programs.

In yet another embodiment, MVCS device **115** further includes an audio speaker, a synthesized voice output, an audio channel, or the like. In an example, MVCS device **115** is implemented, in addition to the receiver, as a set of headphones, the audio portion of a television, a display device, or the like.

In another embodiment, MVCU **110** includes a speech recognition system (ASR) module capable of communicating with MVCS device **115**. In yet another embodiment, the module is capable of functioning as any part or all of the above communication devices and, for another embodiment of the invention, may be capable of data storage, and/or data retrieval, and/or receiving, processing, and transmitting data queries.

Wireless communications system **120** is a wireless communications carrier or a mobile telephone system and transmits to and receives signals from one or more MVCU **110**. Wireless communication system **120** incorporates any type of telecommunications in which electromagnetic waves carry signal over part of or the entire communication path.

In an example, such wireless communication carrier is an analog mobile telephone system operating over a prescribed band nominally at 800 MHz. In another example, such wireless communication carrier is a digital mobile telephone system operating over a prescribed band nominally at 800 MHz, 900 MHz, 1900 MHz, or any suitable band capable of carrying mobile communications. Examples of such digital mobile telephone systems include code division multiple access (CDMA) (e.g. IS-95), Groupe Special Mobile (GSM), and time division multiple access (TDMA).

In yet another example, such wireless communication carrier is a short message service (SMS), modeled after established protocols such as IS-637 SMS standards, IS-136 air interface standards for SMS, and GSM 03.40 and 09.02 standards. Similar to paging, an SMS communication could be broadcast to a number of regional recipients.

Other wireless communication carriers include IEEE's 802.11 standard, Bluetooth® available from Microsoft® Corp. of Redmond, WA, and the like.

Communications network **150** is implemented as any suitable system or collection of systems for connecting wireless communications system **120** to at least one MVCU **110** or to a service provider **170**. In one embodiment, communications network **150** includes a mobile switching center and provides services from one or more wireless communications companies.

Land network **160** connects communications network **150** to service provider **170**. In one embodiment, land network **160** is implemented as a public-switched telephone network, a wired network, an optical network, a fiber network, another wireless network, or any combination thereof. In an example, land network **160** includes an Internet protocol (IP) network. In another embodiment, an MVCU **160** utilizes all or part of the wireless communications system **120**, communications network **150**, and land network **160**.

In yet another embodiment, land network **160** connects one or more communications systems **120** to one another. In another embodiment, communication network **150** and land network **160** connect wireless communications system **120** to a communication node or service provider **170**.

Service provider **170** is implemented as one or more locations where communications may be received or originate to facilitate functioning of the mobile vehicle communication system (MCVS) **100**. Service provider **170** may contain any of the previously described functions.

In one embodiment, service provider **170** is implemented as a call center, as known in the art. The service provider **170** can be implemented in any number of configurations, such as, for example as a voice and/or data call center providing verbal and/or data communications between an advisor and/or advisor data applications in the call center and a subscriber within or outside of a mobile vehicle, as a voice activated call center providing verbal communications between an ASR unit and a subscriber in a mobile vehicle, or as an Internet service providing communications between a subscriber using a client application with a user interface and backend services. In an example, the call center is implemented to service an OnStar® system including one or more of the above examples, such as, an OnStar® Virtual Advisor service providing a voice activated call center to service an OnStar® system.

FIG. 2 is a block diagram illustrating a system **200** for providing a custom message set in accordance with one embodiment of the present invention. System **200** includes a system server **210** and a vehicle client **220**. System **200** may include additional components not relevant to the present discussion.

Server **210** is a server-side system that includes web-client application **211**, modem banks **212- 213**, application server **230**, and database **260**. In one embodiment, server **210** is implemented as an OnStar call center, such as, for example service provider **170** of **FIG. 1** above. Web-client application **211** is a portal allowing access to/from server **210** from outside sources, such as, for example the Internet and the World Wide Web. In one embodiment, web-client application **211** is implemented as an end user website. Modem banks **212- 213** allow server **210** to access vehicle client **220**. In an example and referring to **FIG. 1** above, modem banks **212- 213** are part of service provider **170** and provide access to MVCU **110** via communications network **150** and/or land network **160** and wireless communications system **120**.

Vehicle client **220** includes a vehicle communication services (VCS) application **221** and vehicle bus **222**. VCS application **221** is a software framework that receives proprietary over-the-air messaging schemes and passes the custom message set including vehicle messages to vehicle bus **222** for execution.

Application server **230** is an Internet/World Wide Web application server operating within server **210** that facilitates operation of software applications operating within application server **230** as well as providing conduits into and out of application server **230**. In one embodiment, application server **230** is implemented as a WebLogic application server available from BEA™ Systems, INC. of San Jose, CA. Database **260** receives and stores data from as well as locates and sends requested data to application server **230** and related applications operating within application server **230**. In one embodiment, database **260** stores user profile information, such as, for example service-level information and vehicle type information including vehicle specific data as well as other relevant information discuss below. Database **260** may be implemented as any suitable database application or equivalent data repository, such as, for example Oracle® Database available from Oracle® Corp. of Redwood Shores, CA.

Application server **230** includes portal application **240**, common services application **270**, and communication services application **280**. Application server **230** further includes personal portal **231**, portal skin **232**, and remote administrative portal **235**. Personal portal **231** and remote administrative portal **235** are web-based software frameworks that allow interaction between a client and an application operating within application server **230**. In one embodiment, personal portal **231** provides interaction between a customer and an application operating within application server **230** via the Internet/World Wide Web. In this embodiment, portal skin **232** functions to provide mapping to a specific user profile and provides links to specific applications within portal application **240** based on predetermined criteria, such as, for example a service-level subscription and vehicle type. In another embodiment, administrative portal **235** provides interaction between a call center advisor and an application operating within application server **230** via an intranet. In this embodiment, operation within an intranet reduces security concerns by promoting call center advisor communication directly with portal application **240**.

Portal application **240** is a web-based software framework that creates interaction between a client and an application operating within the portal application. Portal application **240** includes voice channel access port **241**, wireless channel access port **242**, remote doors portlet **245**, additional portlets **246**, and shared components **250**. Voice channel access port **241**and wireless channel access port **242** are access ports that allow additional access avenues to portal application **240** for a client. In one example, voice channel access port **241** allows access to portal application **240** by a client via a voice channel device, such as, a cellular phone or other voice activated telecommunications device. In another example, wireless channel access port **242** allows access to portal application **240** by a client via a wireless device, such as, for example a Short Message Service (SMS) device or a Wireless Application Protocol (WAP) device.

Portlets (**245** and **246**) are applications that interact with a client and provide a client access to specific services based on predetermined criteria, such as, for example a service-level subscription and vehicle type. The portlets make use of the portal software framework connection to application logic behind the graphical user interface (GUI) to allow execution of desired services. In one embodiment, a portlet includes Java Server Pages (JSPs), webflows, and input processors to enable a client to access and interact with the portlet. In an example, if predetermined criteria have been met, remote doors portlet **245** provides a client access to remotely operating (unlocking) doors. In this example, a customer who has inadvertently locked his keys in a vehicle can contact a call center for assistance. The call center advisor, the client in this example, in turn enters portal application **240** via administrative portal **235** and accesses remote doors portlet **245**. Additional portlets **246** represent any number of additional services offered based on a service-level subscription and a vehicle type. In an example, based on the service-level subscription and vehicle type, portlets allow the client (e.g., the customer in this example) to enter portal application **240** via personal portal **231** and portal skin **232**, and access additional portlets **246** to send remote alerts or adjust vehicle personalization settings such as the length of time the dome light remains on after the vehicle is turned off.

Shared components **250** is an interface layer that collects portlet information and produces vehicle service message requests. Shared components **250** includes vehicle message service (VMS) request sender **251**, vehicle information **252**, and user information **253**. VMS request sender **251** produces a request object based on a client request and the portlets associated with the request. Vehicle information **252** and user information **253** request and receive associated information from database **260** based on the client request and provide the information to VMS request sender **251** for encapsulating within the request object to be streamed to common services application **270**.

Common services application **270** is a web-based software framework that supports interaction between applications operating within common services application **270** and applications operating within other web-based software frameworks, such as, for example portal application **240** and communication services application **280**.

Common services application **270** includes vehicle message service (VMS) application **271** that receives a request object from VMS request sender **251** of shared components **250** and produces a custom message set. VMS application **271** includes request object parser **272** and database message query **273**. Request object parser **272** is a parser that parses the received object to remove relevant elements, called vehicle parameters, for further processing. Database message query **273** is a software application that receives the vehicle parameters from request object parser **272** and produces a database query and forwards the database query to database **260** for processing.

Database message query **273** additionally receives vehicle messages from database **260** in response to the database query and produces a custom message set based on the received vehicle messages. The vehicle messages are machine-level instructions for vehicle bus **222** that allow applications running on application server **230** to communicate and manage vehicle client **220** regardless of any proprietary messaging scheme that vehicle client **220** is utilizing. In an example, vehicle messages may be implemented as any suitable messaging scheme or messaging set, such as, for example proprietary over-the-air messages, proprietary vehicle LAN messages (e.g. GM LAN and Class II messages), and other OEM vehicle bus messages. In an example, database **260** includes a look-up table having one or more vehicle messages for each vehicle parameter. In one embodiment, database message query **273** produces a message object, encapsulating the custom message set, and streams the message object to communication services application **280**.

Communication services application **280** is a software framework that supports interaction between applications operating within communication services application **280** and applications operating within web-based software frameworks, such as, for example common services application **270**. Communication services application **280** includes vehicle session manager (VSM) application **281** that receives a message object from database message query **273** of VMS application **271** and passes the custom message set to modem banks **212- 213** for transmission to vehicle client **220**. VSM application **281** includes manager **282**, immediate queue **283**, and delay queue **284**. Manager **282** receives the custom message set from database message query **273** of common services application **270**, assigns a priority value to the custom message set based on communication priorities, and passes the custom message set to immediate queue **283** and delay queue **284** based on transmission priority. In one embodiment, common services application **270** passes the custom message to immediate queue **283**. Immediate queue **283** determines if the assigned priority value of the custom message set matches priority values within immediate queue **283**. In this embodiment, if the assigned priority value of the custom message set does not match the priority values within immediate queue **283**, the custom message set is passed to delay queue **284**. Example communication priorities include the content of the custom message set, vehicle client conditions, message set size, and application related priority. Immediate queue **283** and delay queue **284** pass the custom message set to modem banks **212- 213** per instruction.

In an example, a vehicle client condition indicating that the vehicle client is not operating may result in a lower priority value assigned as the vehicle client is only available for reception of transmission at specific times within the hour. In another embodiment, manager **282** receives a message object, including custom message set, from database message query **273** of common services application **270** and verifies that the custom message set is in acceptable format for transmission.

The present invention includes numerous advantages over the prior art including separation of logic for vehicle communication sessions from logic to communicate a vehicle function message. Additionally, data driven look-up of messages utilizes less resources and is easier to manage and extend than logic embedded in vehicle communication code. Finally, translation to proprietary over-the-air messages, proprietary vehicle LAN messages, and OEM vehicle bus messages can be executed in the database look-up and implemented on the server side thereby minimizing development and management within embedded in-vehicle software.

FIG. 3 is a flow diagram depicting an exemplary embodiment of code on a computer readable medium in accordance with the present invention. **FIG. 3** details an embodiment of a method **300** for providing a custom message set within a vehicle message service system, in accordance with the present invention. Method **300** may utilize one or more systems detailed in **FIGS. 1** and **2** above. The present invention can also take the form of a computer usable medium including a program for configuring an electronic module within a vehicle. The program stored in the computer usable medium comprises computer program code for executing the method steps described in **FIG. 3**. Method **300** begins at block **310**.

At block **320**, a vehicle message service request is received. In one embodiment, the vehicle message service request includes vehicle information, service-level information, and at least one service request. In an example and referring to **FIG. 2** above, VMS application **271** receives the vehicle message service request from VMS request sender **251**.

At block **330**, at least one set of vehicle parameters is determined based on the at least one received vehicle message service request. In one embodiment, the at least one set of vehicle parameters is determined by analyzing the received vehicle message service request for vehicle information, service-level information, and at least one service request. In this embodiment, the at least one set of vehicle parameters is further determined by producing a

set of vehicle parameters for each service request and associated vehicle information and service-level information. In this embodiment, the at least one set of vehicle parameters is still further determined by producing a database query based on the at least one set of vehicle parameters.

In an example and referring to **FIG. 2** above, request object parser **272** parses the received object to remove relevant elements, referred to as vehicle parameters, and including vehicle information, service-level information, and at least one service request. In this example, database message query **273** receives the vehicle parameters from request object parser **272** and produces a database query.

At block **340**, at least one vehicle message is requested for each of the at least one set of vehicle parameters from a database. In one embodiment, the database includes a lookup table having at least one associated vehicle message for each of the at least one set of vehicle parameters. In an example and referring to **FIG. 2**, database message query **273** sends the database query to database **260**.

At block **350**, the custom message set is generated based on the vehicle messages. In one embodiment, the custom message set is generated by receiving a vehicle message for each of the at least one set of vehicle parameters from the database and producing an object including the vehicle messages. In an example and referring to **FIG. 2** above, database message query **273** receives vehicle messages from database **260** in response to the database query and produces a custom message set based on the received vehicle messages.

At optional block **360**, the generated custom message set is transmitted to a vehicle client. In one embodiment, the generated custom message set is transmitted by passing the custom message set to a vehicle session manager, assigning a priority value to the custom message set based on at least one communication priority value, passing the custom message set to one of a plurality of message queues based on the priority value, and transmitting the custom message set to the vehicle client based on the message queue the

custom message set is located within. In one embodiment, communication priorities include the content of the custom message set, vehicle client conditions, message set size, and application related priority.

In an example and referring to **FIG. 2** above, manager **282** receives the custom message set from database message query **273** of common services application **270** and assigns a priority value to the custom message set based on communication priorities. Manager **282** then passes the custom message set to immediate queue **283** or delay queue **284** based on transmission priority. Immediate queue **283** and delay queue **284** pass the custom message set to modem banks **212- 213** per instruction. Modem banks **212- 213** transmit the custom message set to the vehicle client.

At block **370**, method **300** ends.

The above-described methods and implementation for providing a custom message set within a vehicle message service system are example methods and implementations. These methods and implementations illustrate one possible approach for providing a custom message set within a vehicle message service system. The actual implementation may vary from the method discussed. Moreover, various other improvements and modifications to this invention may occur to those skilled in the art, and those improvements and modifications will fall within the scope of this invention as set forth in the claims below.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive.